Current loop transmits ac measurements

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Process-control applications use current loops to send information as an analog signal over long distances with high noise immunity. Using the 3-chip circuit in **Fig 1**, you can measure alternating current or voltage and transmit the results on a 4- to 20-mA current loop. The circuit accepts a 0- to 10-mV ac rms input and provides a 4- to 20-mA output.

The input signal creates a floating voltage across sensing resistor R_{SENSE}, whose size produces 0- to 10-mV rms from the expected sensed current. This floating voltage is the input to a differential-input, single-ended AD22050 sensor interface (IC_1). IC_1 operates at a gain of approximately 20 and drives the low-impedance (8-kΩ) input (pin 1) of the AD736 rms-to-dc converter (IC_2). This converter's full-scale range is 200 mV rms. IC_2's output drives IC_3, an AD694 voltage to 4- to 20-mA current-loop interface.

Because of their low power consumption, both IC_1 nd IC_2 can operate from the 10V supplied by IC_3's reference output at pin 7. IC_3, and hence the entire circuit, operates from the standard 24V loop supply. Because this circuit operates from a single supply, you must bias IC_2's common input at ½ of IC_3's 10V output, or 5V. The voltage divider comprising R_1 and R_2 divides the 10V to 5V. R_2 is in parallel with a 10-kΩ resistor inside IC_3.

IC_3's internal buffer amplifies the difference between IC_2's output at pin 6 and the 5V rail. This difference ranges from 0- to 200-mV dc for a 0- to 10-mV rms input and produces a 4- to 20-mA current output from IC_3. R_3 allows you to adjust the circuit's gain. R_4 and R_5 set the gain of IC_3's internal amplifier to 10. R_5 matches R_4 to prevent offsets due to the internal amplifier's input-bias current. This circuit's accuracy is 1.2% of readings from 20 Hz to 40 Hz and 1% of readings from 40 Hz to 1 kHz. The −3-dB bandwidth is 33 kHz. **EDN BBS /DI_SIG #1167** EDN

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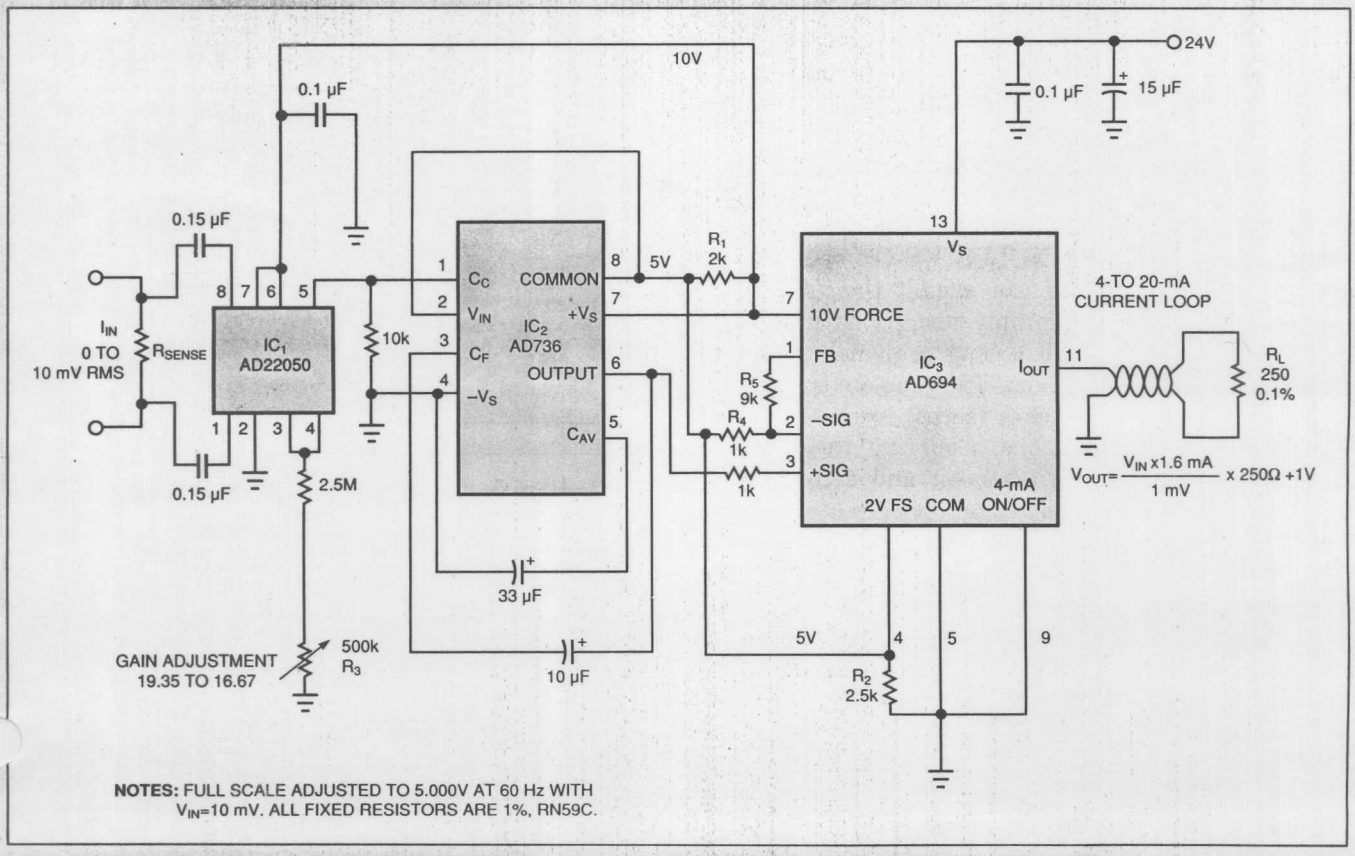

NOTES: FULL SCALE ADJUSTED TO 5.000V AT 60 Hz WITH V_{IN}=10 mV. ALL FIXED RESISTORS ARE 1%, RN59C.

Fig 1—This circuit measures alternating current or voltage and transmits the results on a 4- to 20-mA current loop.